

Applicants : Anil V. Nadkarni et al.  
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Filed : July 11, 1996  
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from a high density component, and a low density, or binder, constituent consisting of either a metal alloy or a plastic blend. Copper is recited as one of the possible low density metal constituents. In the description of the method of Mravic et al., at col.4, lines 27-29, it is stated that "[t]he proportions of the several powders would be those required by the rule of mixtures to provide a final density about equal to that of lead." To achieve these projected densities, copper must be a minor component.

The metal matrix composites whose densities are set out in figure 1 of Mravic et al., are described at col. 6, lines 11-13 as made in "[t]he proportions [of W, WC or WFe to either tin, bismuth, zinc, iron, aluminum or copper] such that they would have the density of lead if there were no porosity after sintering." Referring to Figure 1, the charted metal matrix composite containing copper appears to have about 85% W, and hence, no more than 15% copper. The only other example in Mravic et al. of a metal matrix containing copper is a copper containing bullet, code 11, in Table 1. The code 11 bullet contains 72% FeW, and hence, no more than 28% copper. It is clear therefore in Mravic et al. that the copper must comprise only a minor portion of the metal matrix composite. With the above amendments, Applicants have limited their claims to powders, bullets, and their method of manufacture, comprising predominantly Cu or Cu alloy powder, thus clearly distinguishing the claimed invention over Mravic et al.

In paragraph 3 of the above-identified Office Action the Examiner has raised the issue of joint invention of the claims in relation to the prior art. All the claims in the present Application were commonly owned.

In paragraph 4 of the Office Action the Examiner has rejected Claims 9-12, 27-34 under 35 U.S.C. 103(a) as being obvious from Mravic et al. While Mravic et al. is cited as

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disclosing only a lubricant additive, the Examiner states that it is common knowledge in the prior art to use graphite or  $\text{MoS}_2$  as a solid lubricant to ease die release, and to use them in an amount **to minimize their effect** on sintered articles . In the present invention, "stearate or wax is used for die release" (page 6, lines 10-11), and graphite and  $\text{MoS}_2$  **are added for their effect** on the sintered bullets made therefrom. In small amounts, graphite has little effect on frangibility (and  $\text{MoS}_2$  reduces frangibility), but in quantities sufficient to coat the copper powder particles with inert second phases, the graphite partially impedes the sintering process so that the bonds between the particles are embrittled (page 8, line 11-13 of the specification). Neither Mravic et al. or the common knowledge set forth by the Examiner show the use of predominantly copper or copper alloy powder, the addition of graphite or  $\text{MoS}_2$  to effect frangibility, the quantities of graphite or  $\text{MoS}_2$  needed, or the fact that  $\text{MoS}_2$  would produce an opposite effect on frangibility. Hence applicants maintain that Claims 9-12, and 27-34 are not obvious from Mravic et al., and are, in fact, patentable thereover.

In paragraph 5 of the above-identified Office Action the Examiner has rejected Claims 3-8, 13-16, 17-20 and 35-48 under 35 U.S.C. 103(a) as obvious from Mravic et al. in view of the ASM Handbook (pp.710-716, 802-813) which teaches the use of dispersion strengthened copper with alumina (see p.711), oxides, carbides and nitrides (see p.710) for the purpose of increasing the strength in the copper formed article. The ASM Handbook reference is stated by the Examiner to disclose borides with ceramics that are added to metal for increased strength, thus suggesting borides as a ceramic equivalent. In the present invention, these additives are used for the **opposite** effect; to **inhibit** the forming of strong copper to copper bonds thereby weakening the part and making it more frangible. Applicants maintain that this use is not obvious from Mravic et al. in view of the ASM Handbook, and that the claims so rejected are not obvious and are clearly patentable over the references cited.

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In paragraph 6 of the Office Action, the Examiner has rejected Claims 21-24 and 49- 52 under 35 U.S. C. 103(a) as being unpatentable over Mravic et al. in view of the ASM Handbook (pp.710-716, 802-813 and 121-122) While Mravic et al. does not show alloyed copper, the ASM Handbook is cited as indicating that the copper/tin/zinc powder may be premixed before use, to ensure homogeneity of the mixture. While the copper/tin/zinc may be premixed, neither Mravic et al. or the ASM Handbook recognize that with the additives of the present invention, or the small changes in the sintering temperatures (Table 6) set forth in the present application, a wide range of frangibility can be achieved with bronze and brass alloys. Hence Applicants maintain claims 21-24 and 49-52 claiming a powder and a frangible bullet made through compressing a predominantly prealloyed brass (or bronze) powder of 5-40% zinc (or 2-20% tin) are not obvious from, and are indeed patentable over, Mravic et al. in view of the ASM Handbook.

In paragraph 7 of the Office Action the Examiner requests designation and provision of a description of the trademarks RXM, RXH, FOS-WC and Acrawax<sup>®</sup> used on pages 10 and AL-25 on page 13. RXM, RXH, and FOS-WC are grade designations of the manufacturer, SCM Metal Products Inc., and are not trademarks. AL-25 is the grade designation for a dispersion strengthened copper material, of generic designation C15725 in the Unified Numbering System (UNS). GlidCop<sup>®</sup> is the trademark for this material, and the specification has been amended to reflect this. Acrawax<sup>®</sup> is the trademark of Lonza Corporation. The generic name for Acrawax<sup>®</sup> is N,N'-ethylenebisstearamide, and its chemical family is alkyl amide. With this amendment, Applicants have added this information to the specification.

Applicants believe that the teaching of Mravic et. al enhances the patentability of the present invention. Mravic et al. is looking for materials to make bullets of density approaching that of lead (requirements 1 and 2) that are frangible (requirement 3). Although Mravic et al.

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are aware of the metal powders, copper powders, additives, die pressing, and sintering, they teach away from the powders, bullets and method of making the same, set forth in the present application and claims. In addition, unlike the bullets of the present invention, the bullets of Mravic et al. must be coated to remain intact and not erode the gun barrel (requirements 4 and 5). The copper and copper alloy powders of the present invention even meet the 6th and last requirement of Mravic et al., reasonable cost, yet Mravic et al. does not disclose the proportion, or the method of assembling the ingredients to achieve the goals stated therein. Applicants therefore maintain that the invention of the present application is not disclosed or rendered obvious by Mravic et al. alone, or in view of the ASM Handbook, and respectfully request reconsideration and allowance of the claims as amended.

If it would be helpful in expediting examination of all the claims in this application, the Examiner is respectfully requested to telephone the undersigned attorney at the number below to discuss the subject application.

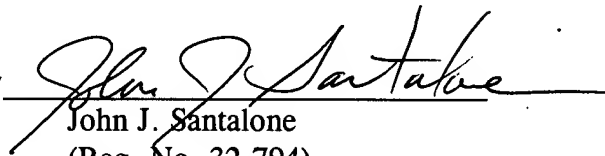
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As this amendment is timely filed within the January 14, 1998 due date, no fee is deemed due. If any fee is deemed necessary, authorization is hereby given to charge the amount of any such fee to Deposit Account 11-0171, and to credit any overpayment thereto.

Respectfully submitted,

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